

**Remarks by The Honorable Frederick Gregory
NASA Deputy Administrator
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Thank you Alan (Alan McMillan, President National Safety Council) for that very gracious introduction, and for the wonderful musical tribute to our space program.

It is an honor to address this distinguished gathering of safety and health experts from over 50 nations.

Today, I want to talk to you about how NASA, the world's leading research and exploration agency, is approaching the issue of safety in the most unique of workplaces—the high performance space vehicles that we launch into the heavens some 60 miles or 100 kilometers east of here at the Kennedy Space Center.

I hope that NASA's experience in improving our approach to safety following the tragic Space Shuttle Columbia accident may provide useful ideas for improving safety in your work environments.

But first, I would like to say a couple things about a subject very much on our minds, the devastation of Hurricane Katrina.

For those of you who have personally experienced this natural disaster, my heart goes out to you. The same applies to those who experienced the Sumatra Earthquake and Indian Ocean Tsunami late last year.

We at NASA are gratified that our space observation capabilities proved useful in efforts to deal with both natural disasters.

In the case of Katrina and other tropical storms, as a result of relatively new NASA satellites and instruments, our colleagues at the National Oceanic and Atmospheric Administration are now able to predict the formation of tropical storms nine days out instead of seven days. They are also able to predict a storm's landfall within a 400 mile area instead of 800, or 650 kilometer area instead of 1300.

Following the hurricane and last year's tsunami, NASA satellites and aircraft assisted rescue and recovery operations by providing detailed high-resolution observations of the disaster areas.

This information helped provide an accurate assessment of damage to communities and coastal environments and enabled U.S. Navy ships involved in the tsunami relief effort to safely enter ports.

Additionally, the information provided by our satellites is being used to investigate the event and document the devastation caused by the tsunami.

This research will aid in the future development of tsunami and earthquake predictive models and warning systems.

Of course, we pay attention to disasters like these because they are extraordinary events that don't happen every day. At this conference I know there will be much productive dialogue about improving health and safety in the day-to-day work environment.

While some aspects of NASA's high-technology work environment is by its very nature quite unique, we also have office and factories that experience typical safety concerns. I believe the lessons we have learned both from our experiences in the high-risk business of human space flight, and in the day to day operations of the Agency may have broader applicability to this audience.

For one thing, all of us, when we wake up in the morning, accept some degree of risk. So we all have this in common, although the risks we are subject to differ in degree. As an astronaut I entered our spacecraft knowing that my commute to work would be just a bit out of the ordinary.

Let me give you a taste for what it is like to be strapped into the crew compartment on the Space Shuttle waiting for the solid rocket boosters to kick start you on your way into orbit.

(Describe your experience during a Shuttle launch)

Yes, spaceflight is inherently a dangerous business. But as William Shedd once said, “A ship at harbor is safe. But that’s not what ships are for.” So we take on great risks as we seek out great goals.

NASA's objective, through what we call the Vision for Space Exploration, is to extend the reach of human civilization throughout the cosmos, using a combination of astronaut pioneers and robotic pathfinders.

As we move forward in the coming decades to set up base camps on the moon, and then move onward to explore Mars and beyond, we know that we will be taking on several significant challenges.

How do you feed crews on a barren planet for example?

How will our crews be able to perform surgeries, or for that matter routine medical procedures, at these celestial work places?

How will we protect these explorers from dangerous exposure to radiation?

And how will we address the psychological needs of people living long periods of time away from their home planet.

Work is already underway at NASA to address these challenges. I submit to you that once we develop answers and solutions, our innovation may well have applications for the work environments you deal with or some of the disasters we will have to manage in the future.

NASA's philosophy about risk is quite straightforward. We identify and characterize risks, do our best to minimize or mitigate them, and for any residual risk accept the possibility we may have failures along the way in the course of extending our exploration horizons.

Challenge fosters excellence, often drawing on previously untapped skills and ability. While risk can often be reduced or controlled, there comes a point when the removal of all risk is either impossible or so impractical that it completely undermines the very nature of what NASA was created to do—to pioneer the future.

Of course throughout NASA's 47 year history, it is sobering to note that for all the amazing progress we have achieved in the skies and heavens above, we have also suffered from enormous tragedies, including the loss of our heroic Apollo One, Challenger and Columbia astronauts.

These tragedies have touched me personally as the Challenger and Columbia astronauts were my friends.

Nearly twenty years ago, I was at Mission Control at our Johnson Space Center in Houston, Texas, serving as the Capsule Communicator or Capcom, when the Challenger lifted off.

The loss of the Challenger crew still pains me today, as does the loss two-and-a-half years ago of the Columbia astronauts.

In the aftermath of tragedy, hopefully comes knowledge and wisdom. Indeed, throughout our history, NASA has demonstrated a tremendous capacity to recover from our setbacks through a process of learning from our mistakes, and improving our safety practices.

That resolve was put on display this summer with our return to flight of the Space Shuttle, and currently with our resolve to re-intensify our efforts to further reduce or eliminate the possibility of damaging foam losses from the Shuttle's External Tank during the liftoff sequence.

We know in our business, while that although you can't do everything perfectly, our safety margins are so slim we have to be as close to perfection as humanly possible. So we are striving very hard to set the safety bar even higher.

Still, we know the Shuttle system is inherently not as safe as we'd like it to be. That's why we will retire the Shuttles by 2010 and build a new crew exploration vehicle that will have many new safety features such as a crew escape capability. We believe these features will significantly reduce the risk of future human space flight.

I'd now like to provide some behind the scenes perspective on how NASA has approached the work of improving safety practices since the Columbia accident.

To be accurate, this story begins with the contingency planning we had in place prior to Columbia's mission in 2003.

And the key point here is that whether you work in a high-risk agency like NASA, or in many of the office or industrial environments familiar to those of you in this audience, it is vital to have a contingency plan to address a variety of “worst case scenarios.” It is not enough just to have a plan. It must be practiced with great regularity and revised as events warrant.

NASA updates our contingency plan for human spaceflight before every Shuttle launch, based on experiences gained from prior missions and on new understanding of the literally thousands of variables that must be considered when we mount a complex space mission.

Let me give you some examples of these variables. First, on launch day we have to look at the weather at the Kennedy Space Center and at several emergency landing sites across the Atlantic, and in Australia and California.

In our initial return to flight missions, we will only launch during daylight hours, so as to get the best possible imagery of the Shuttle during liftoff.

We have very tight time periods in which we can launch on a planned launch day due to the complicated orbital dynamics we face in sending the Shuttle to rendezvous with the International Space Station. And the list goes on...

There is another important benefit of contingency planning and practicing responses to non-routine or even dire circumstances. We like to talk about NASA as being a family. Within our close-knit community, many of us have strong personal friendships with the members of the astronaut corps. Because this bond is so strong, we would be less than human if we did not respond emotionally to any indication of an astronaut in peril.

We found out that in our time of crisis, the ability to lean on the tools of our planning enabled us to respond appropriately at a very difficult emotional time.

Of course, as the Columbia mission was underway, having to work through a real Shuttle accident was far from our minds. I was at NASA Headquarters the Saturday morning the Columbia crew was set to return to the Kennedy Space Center.

Following the shock of realizing the crew was lost, I took a deep breath and began to focus on the immediate requirements of the moment. These included setting up a crisis center at NASA Headquarters, putting in motion an independent accident investigation board, and sending some of our best people to the piney woods of eastern Texas, where they would conduct hard work of recovering debris from the Columbia orbiter.

While this was happening, other NASA officials made certain that the family members of the Columbia astronauts were cared for. Within the astronaut corps we assign astronauts to take care of the practical and emotional needs of family members in the event of an accident such as this. We call them casualty assistance officers, and they do a great job.

I don't know how many of you have a similar buddy system, but you would be well advised to institute one.

Incidentally, since the Columbia accident we've extended this practice of supporting our people of time of need through the NASA Family Assistance Fund. This fund is currently being tapped to provide emergency grant and loan aid to hurricane affected NASA employees and their families at our Stennis Space Center in Mississippi and Michoud Assembly Facility in New Orleans.

Also that morning, our Administrator promised that NASA would find the problems that led to the accident, solve them, and do everything we could to conduct future space missions as safely as humanly possible.

One of the keys to determining the cause of the Columbia accident was the incredible debris recovery operation that took place in eastern Texas and western Louisiana.

When we began this effort, the experts told us we'd be fortunate to recover 15 percent of the orbiter. The fact that we were able to recover over 40 percent of the vehicle stands as a tribute to hundreds of volunteers from NASA, other federal, state and local government agencies, and from communities around the country.

Armed with evidence from the recovery of Columbia debris and extensive interviews with technical experts, the independent Columbia Accident Investigation Board was able to describe how the accident was caused by a combination of hardware, process, and human failures.

Without hesitation, NASA accepted the Board's findings for improving Shuttle safety and pledged to raise the safety bar even higher.

We've taken a number of institutional actions since the Board's report to emerge as a safer, stronger and smarter agency. I like to describe them as multiple safety checks.

First, we empowered another independent group, this one led by former astronauts Thomas Stafford and Richard Covey, to review the progress of our actions toward safely resuming Shuttle flights.

The Stafford-Covey Return to Flight Task Group has been very forthright in their analysis of our work. Some of the members were quite supportive of our efforts, and others have been critical of our work to instill an improved culture of safety throughout the Agency.

We welcome this criticism, as we know we are never going to achieve our bold exploration objectives by sticking our head in the sand. And one of the values that we really are trying to live up to is to encourage all of our employees, no matter what their position or degree of experience, to speak out openly if they have any safety concerns about our mission operations.

Then there are specific actions we've taken within NASA. We have created a permanent Space Operations Center at our Headquarters office, which serves as an Agency crisis command post when needed. Most recently we used it to centralize NASA's response to Hurricane Katrina.

We have stood up a group of Technical Warrant Holders. These are NASA experts in various technical fields who are not beholden to program managers. We are counting on them to give us their best and unvarnished judgment on what is technically acceptable in matters involving safe and reliable operations, independent of all cost and schedule considerations. These Technical Warrant Holders, in effect, are NASA's technical conscience and have exclusive authority to consider whether deviations from technical requirements are ever acceptable.

We've also created an organization at our Langley Research Center in Virginia called the NASA Engineering and Safety Center. Using the greatest talents of the agency this group is tasked with providing NASA in-depth, value-added technical assessments, analyses and tests to assure we have the best characterization of risk in support of our decision making.

Mishaps at NASA don't just involve space hardware and astronauts. We have many occupational and industrial environments that are similar to those you deal with. Accordingly, we've also taken steps to strengthen investigation requirements for all mishaps involving NASA employees.

To underscore our firm commitment to protecting life and property, I am notified immediately when a mishap involving any of our workers results in an injury causing lost time or

causes significant property loss. Once I receive such reports, I have the ability to act very proactively and suggest remedies to management.

I am also notified when we have a significant close call event that might serve as an opportunity for us to gain knowledge that will help us prevent future mishaps.

Further, in the event of a mishap, we get involved to ensure all appropriate steps are taken to care for the injured and their families, make the site safe, and investigate the mishap to understand its root causes for the purposes of preventing future occurrences.

Aside from mishap and close call investigations, we also encourage the reporting of hazards by employees and managers alike in order to correct situations that may lead to problems down the road. As a special consideration for those employees who may be reluctant to speak out openly, we offer the

opportunity for them to anonymously report safety concerns about any operation within NASA to our Safety Mission Assurance Office at Agency Headquarters. In an average year this office typically handles about 100 reports of safety concerns.

We've also improved the ability for all levels of NASA management to obtain timely and useful information about mishaps.

In a hypothetical example, a manager at one of NASA's 10 centers can tap into a novel web-based application called the Erasmus information system to learn how we respond to an incident at another center such as a toxic fuel spill. This system also contains long-term incident trend information.

Once an incident occurs, each NASA center and responsible program is expected to immediately implement contingency plans to ensure public and personnel safety, prevent further losses, secure the mishap scene, and initiate the investigation process.

In the future, if God-forbid, we have another accident in space flight, NASA will form an independent investigative authority structured similarly to the Columbia Accident Investigation Board.

These experts will reconstruct the mishap or any close calls by creating a timeline of the sequence of events and conditions that transpired prior to the mishap.

Each event and condition will be further analyzed to determine its cause and role in the accident. It is our philosophy that mishaps usually result from a chain of events and conditions, each having a cause. Properly identifying all the causes and clearly substantiating the cause-effect relationship will be critical to our understanding of the mishap or close call and our ability to implement effective corrective actions.

Once the proximate causes are identified as being the result of human actions or errors, equipment failures, weather changes, external events, or a combination of these, we want our investigators to ask “why” these events contributed to the accident so that we can understand the causal chain.

After the investigating team has identified the causes of the mishap, they will generate clear, achievable, and verifiable recommendations that address both the proximate causes and the root causes.

By implementing recommendations that address the proximate causes, we can stop the causal chain at its inception and prevent a similar accident from occurring for those specific causal reasons.

Looking outward, as part of our effort to improve safety performance throughout the agency NASA's senior leadership has met with industry safety leaders, such as current and former industry Chief Executive Officers of Alcoa and DuPont, to share best practices.

Using lessons-learned from these discussions we are determining how we can tap these companies' practices to improve our own response, investigation, monitoring, and prevention of mishaps.

We are also utilizing the Voluntary Protection Program of the U.S. Occupational Health and Safety Administration that was developed for private industry, but was opened to federal agency participation a few years ago. This is a managerial approach to preventing mishaps in the workplace environment, that involves education, and training in tasks that are important for safety, and sophisticated hazard analysis. All of our NASA Centers are

pursuing the highest level of compliance in the Voluntary Protection Program, Starr Certification. In fact, our Langley Research was the first such federal organization to achieve that distinction.

With a strong commitment to excellence in all aspects of our work, a strengthened safety ethos throughout our culture and an enhancement of our technical capabilities, we now hope to make great strides in our new quest to extend the reach of civilization to the cosmos.

Friends, I think the hardest thing to do in the space exploration field is to make trades between risk and reward.

As an astronaut, I willingly strapped myself into the Shuttle orbiter knowing that a lot of talented people were dedicated to my safety, but also recognizing that spaceflight is inherently dangerous.

I guess you can say I had a pilot's typical disdain for risk. Now that I am on the management side, I am very mindful of the need for organizations to intelligently grapple with the need to reduce risk, while still moving forward. I am not risk averse by nature, but I do believe I am risk informed.

Moving forward, armed with a new network of multiple safety checks, we believe we are far better equipped to execute our program activities safely.

We are determined to honor the legacy of the heroic Challenger and Columbia astronauts by blazing a trail to the stars. But as the motto of the great state of Kansas appropriately tells us: "ad astra per aspera." That is Latin for "To the stars through difficulties." I think we all can relate to this statement.

In sum, I hope my discussion of NASA's approach to embracing risk in an intelligent manner provides fodder for your thinking and discussion during this conference.

I commend you for your dedication to enhancing working conditions for millions of people around the globe, and I thank you once again for your warm hospitality.